The Newcastle GNAAC Annual Report for 2001-2002

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The GNAAC at University of Newcastle continued activities with submissions of weekly G-network and P-network SINEX files. The analysis procedure outlined previously (Davis & Blewitt, 2000; Nurutdinov et al., 2000) remained unchanged throughout the years 2001-2002. The IGS97 realization of ITRF97 has been used to constrain the solutions for GPS weeks 1065-1142. Starting with GPS week 1143 it has been replaced with IGS00 realization of ITRF2000. Combined solutions for Earth Rotation Parameters (X_p, Y_p, LOD) have been produced starting with week 1159.

G-network Results

A-network SINEX data from all seven global analysis centres (COD, EMR, ESA, GFZ, JPL, NGS, SIO) were processed. The appearance of a station in a minimum of three solutions defines a global station for inclusion in the combined NCL G-network (Figure 1). Any remaining stations and RNAAC (AUS, EUR, GSI, SIR) stations (Figure 2) are defined as regional stations and are included in the P-network along with global stations. During 2002 an average of 116 global and 84 regional stations appeared in the weekly P-network what is higher than during 2001 (103 global and 75 regional stations) and 2000 (100 and 60 respectively).

The loose G-network solution (GNET) is estimated from block of normal equations composed of each de-constrained A-network. The corresponding covariance matrix is augmented to remove Helmert rotation parameter constraints. This solution is constrained later to the CORE network, consisting of 51 stations of IGS97 or 54 stations of IGS00, for the months Jan-Nov 2001 or Dec 2001-Dec 2002 respectively.

Figure 3 shows the weighted RMS of residuals for each weekly A-network solution after Helmert transformation to the weekly loose G-network solution. Values for weighted RMS are in the region 2-9 mm describing repeatability of the G-network estimates.

Figures 4 through 7 show the translational parameters for 7-parameter Helmert transformation from deconstrained AC and GNET solutions to CORE network.

The effect of introducing of IGS00 realisation of ITRF2000 in December 2001 instead of IGS-97 realisation of ITRF-97 used before is seen clearly from Figure 9. Mean values of the scale parameter of the Helmert transformation from AC solutions to the IGS CORE network became 1.5-4 times smaller.

P-network Results

The creation of the P-network is based on the G-network and the weekly input R-SINEXes from the RNAACs. A minimum of three global and one regional stations is required for inclusion of a solution in the P-network. In the “attachment” method of network combination the G-network is not allowed to be perturbed by the R-networks. Figure 8 shows of the RMS residuals of station coordinates after 7-parameter Helmert transformation of the deconstrained R-network to the G-network.

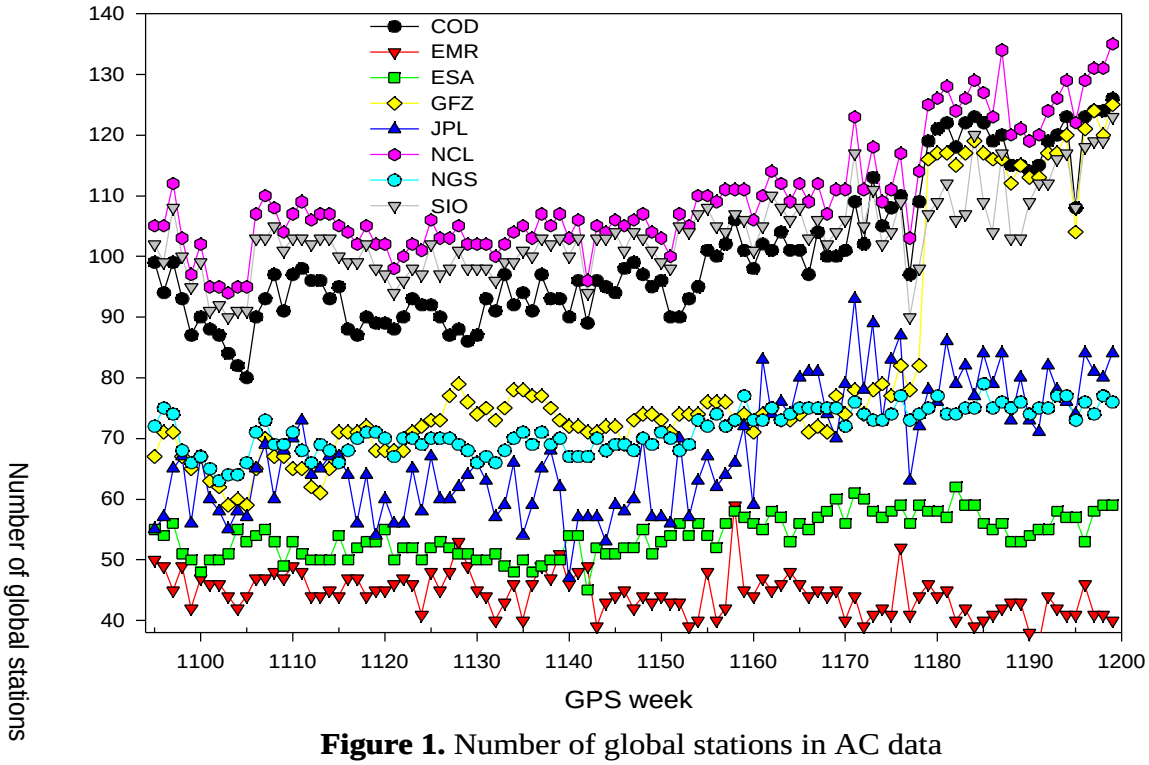

Figure 1. Number of global stations in AC data

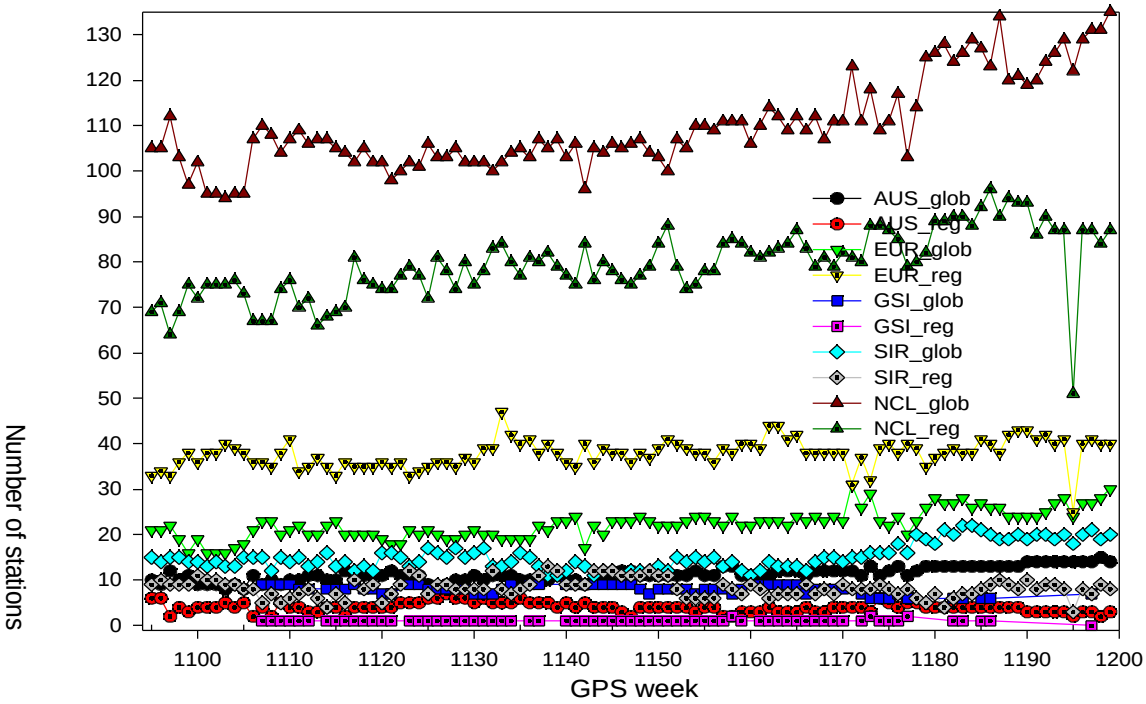

Figure 2. Number of global and regional stations in RNAAC and P-network solutions

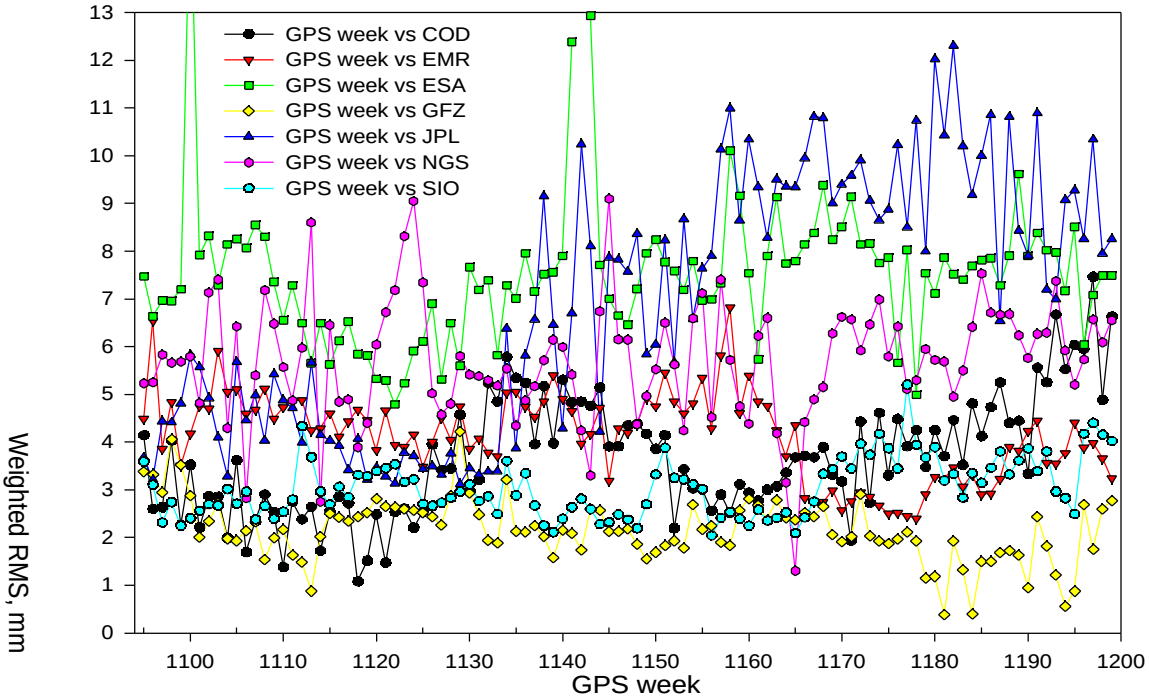

Figure 3. Weighted RMS of residuals for AC network transformation to loose NCL G-network

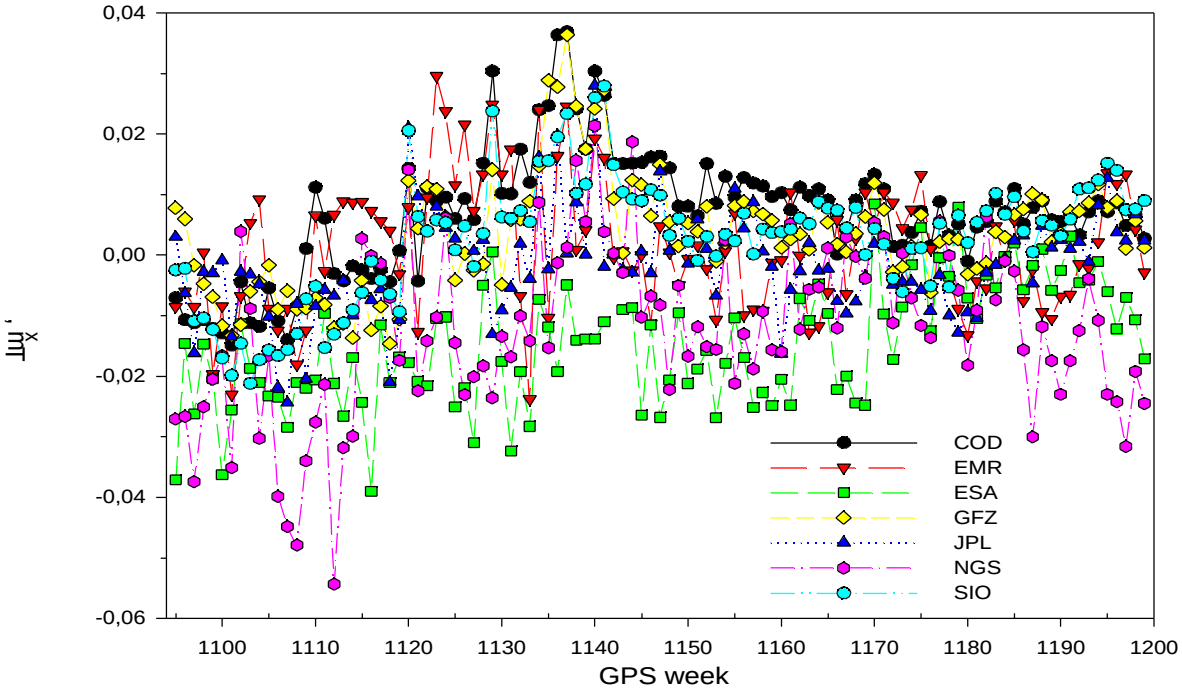

Figure 4. Time series of T_x transformation parameter for the ACs to ITRF

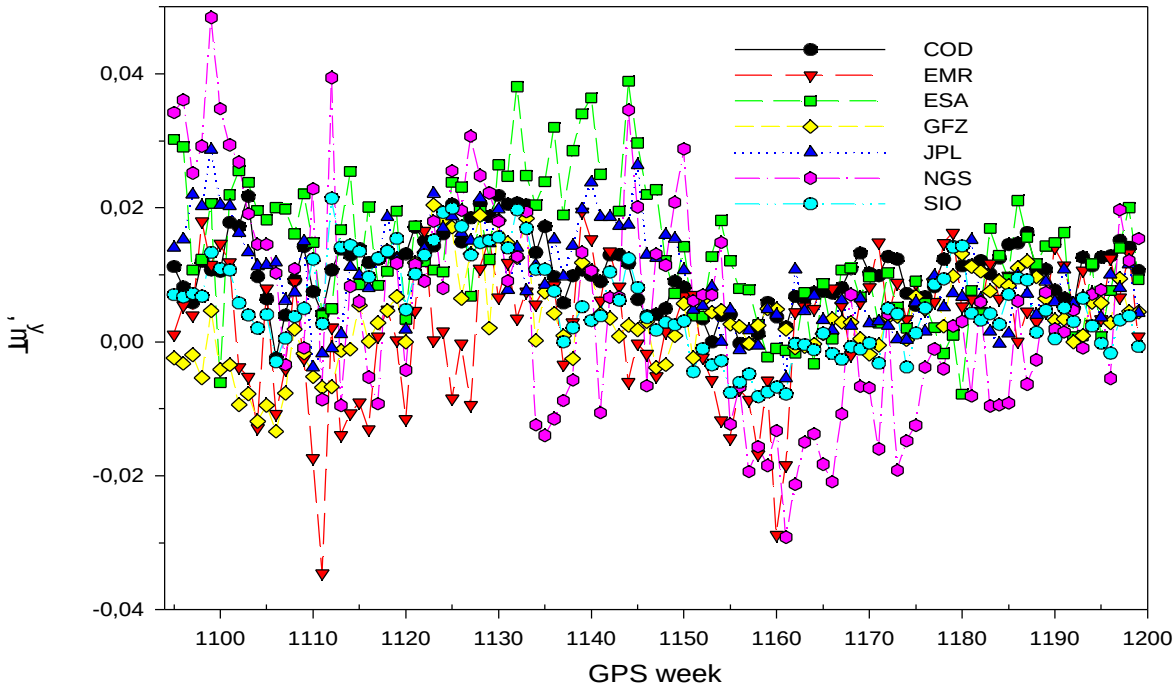

Figure 5. Time series of T_y transformation parameter for the ACs to ITRF

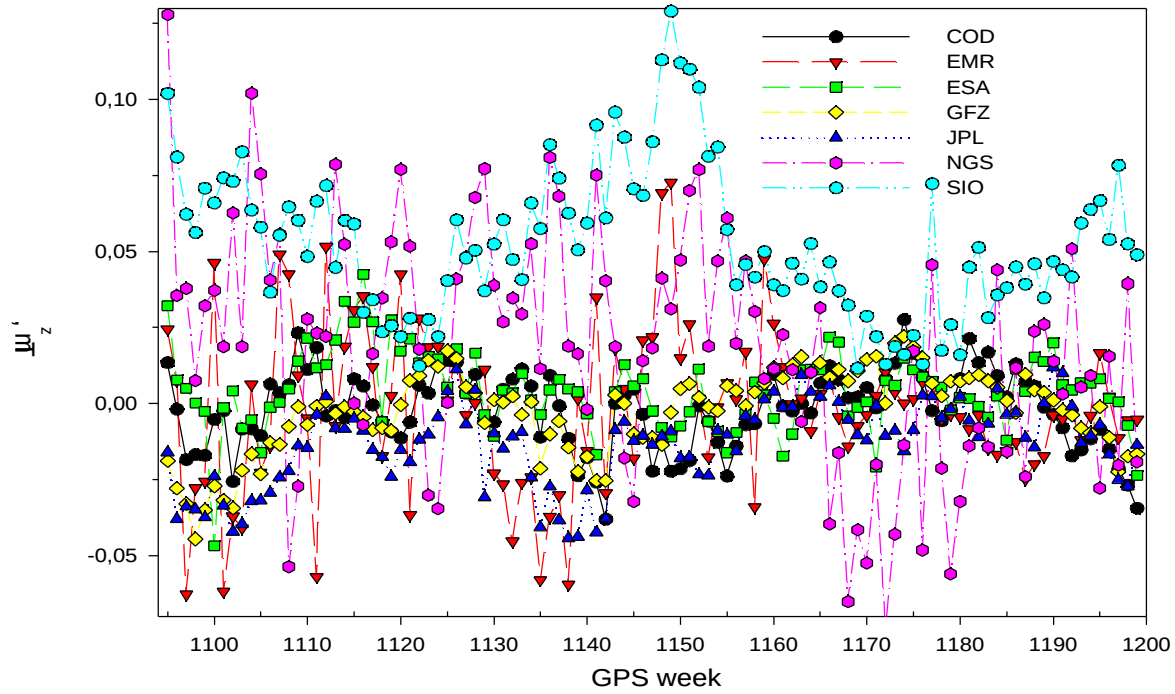

Figure 6. Time series of T_z transformation parameter for the ACs to ITRF

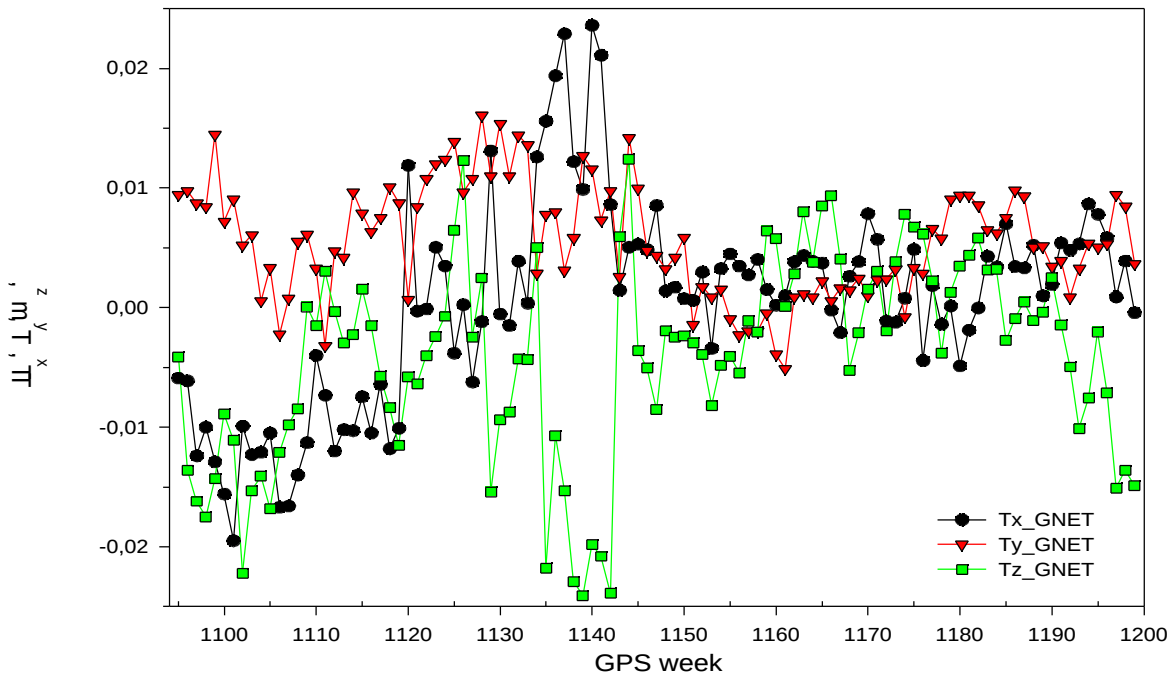

Figure 7. Time series of T_x , T_y , T_z transformation parameters for the NCL GNET to IGS

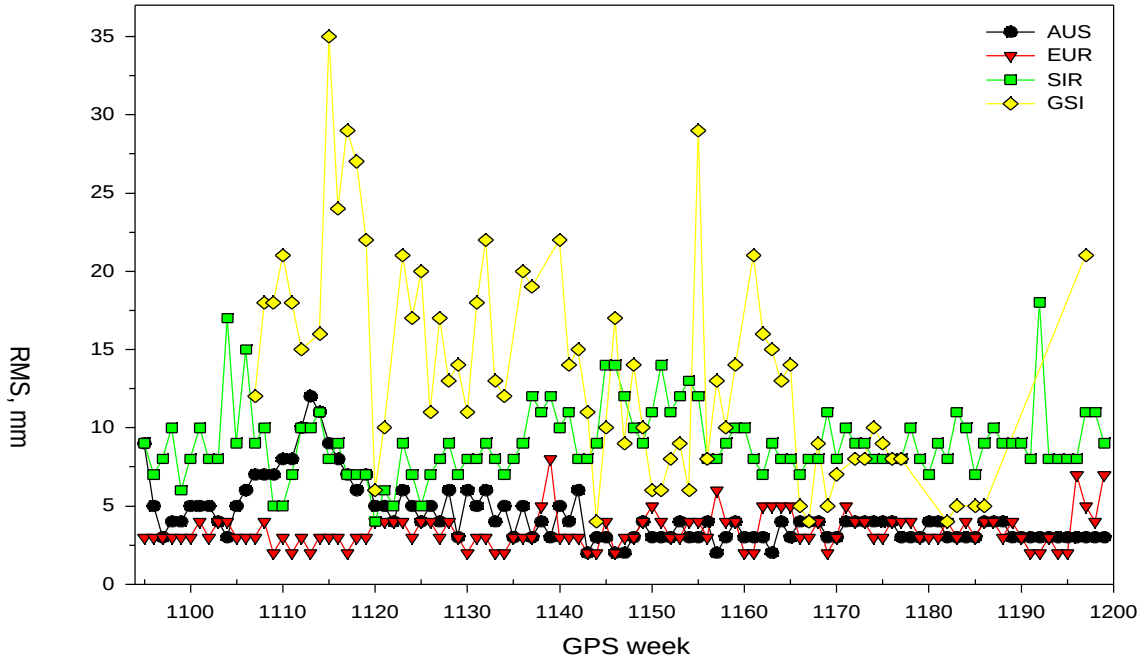

Figure 8. RMS of residuals for RNAAC R-network transformation to loose NCL G-network

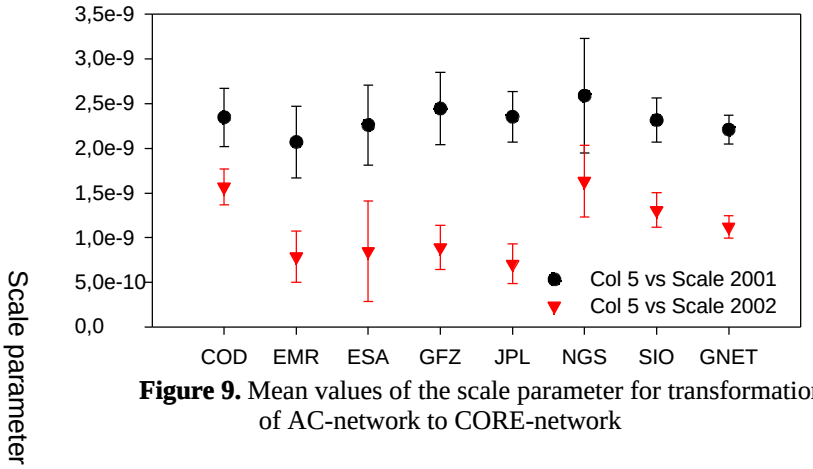

Figure 9. Mean values of the scale parameter for transformation of AC-network to CORE-network

Other activity

NCL GNAAC P-sinex solutions over a five-year interval have been used to detect seasonal variations of station coordinates and geocentre position (Blewitt *et al.*, 2001a, 2001b). Contribution of seasonal interhemispheric (degree 1) mass transfer to variation in global mean sea level and nonsteric static ocean topography has been calculated, using published GPS results for seasonal degree-1 surface loading from the global IGS network (Blewitt & Clarke, 2003).

An online SINEX-checking facility to assist ACs in submitting SINEX files has been created at http://ucscgi2.ncl.ac.uk/~nkn3.

Summary and Outlook

The GNAAC at University of Newcastle continued to submit weekly G-network and P-network SINEX files to IGS. In the 2003, the Newcastle GNAAC continues to submit combined solutions to IGS. The TANYA software is developing further (Blewitt et al, 2000).

References

P. Davis, G. Blewitt, Methodology for global geodetic time series estimation: A new tool for geodynamics, J. Geophys. Res., Vol. 105, No. B5, pp. 11,083-11,100, 2000.

K. Nurutdinov, D. Lavallee, P. Clarke, G. Blewitt. The Newcastle GNAAC Annual Report for 1998-1999. Int. GPS Service for Geodyn. (IGS) 1999 Techn. Reports, 125-130, 2000.

G. Blewitt, P.J. Clarke, D. Lavallee and K. Nurutdinov. Degree one harmonic deformations weigh interhemispheric mass transport; a new method for determining geocenter variations. EOS Trans. AGU, 82(20), Spring Meeting supplement, S19, 2001a.

G. Blewitt, D. Lavallee, P. Clarke and K. Nurutdinov. A New Global Mode of Earth Deformation: Seasonal Cycle Detected. Science, Vol 294, pp.2342-2345, 2001b.

G. Blewitt, P. Clarke. Inversion of Earth's changing shape to weigh sea level in static equilibrium with surface mass redistribution. *J. Geophys. Res.*, **108**(B6), 2311 (doi:10.1029/2002JB002290), 2003.

G. Blewitt, D. Lavallee, P.J. Clarke, K. Nurutdinov, W.E. Holt, C. Kreemer, C.M. Meertens, W.S. Shiver and S. Stein. GPSVEL project: towards a dense global GPS velocity field. In 10th General Assembly of the WEGENER Project, extended abstracts book, Bulletin RAO 3/2000.